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NEW FROGS OF THE GENUS *CORNUFER* (RANIDAE) FROM THE SOLOMON ISLANDS

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INTRODUCTION

Large collections made by Mr. Fred Parker on Bougainville and neighboring small islands are providing very considerable additions to our knowledge of the fauna of this area. The present paper reports three new species and one new subspecies of the genus *Cornufer* discovered by Mr. Parker. Future papers in this series will describe other novelties in both frogs and reptiles and will record important ecological and behavioral observations.

PLATYMANTIS SYNONYMIZED WITH *CORNUFER*

In my revision of the amphibians of the Solomon Islands (Brown, 1952), I followed Boulenger (1918, p. 372), Noble (1931, p. 522), and Deckert (1938, p. 148) in maintaining *Platymantis* and *Cornufer* as distinct genera. My separation of the two genera was based primarily on the structure of the digital pads, as emphasized by Boulenger (1918, p. 372). On the basis of this character, the Solomon Islands representatives of this group of ranid frogs, which were known at that time, fitted rather readily into one or the other of the two categories. Inger (1954, p. 348), on the basis of his experience with the Philippine ranid frogs, again placed *Platymantis* in the synonymy of *Cornufer*. In so doing, he pointed out the difficulty of maintaining a separation of these two genera when a majority of the species is considered and the apparent evolution of the digital pads is taken into account. However, he did note that the species of

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this group do have a number of characters in common, which separate them from *Rana* (*sensu stricto*). As to their relationships with other ranid genera, it has been noted by Noble (1931, p. 520) and Brown (1952, p. 36) that as a group they are probably more closely related to the genus *Discodeles*, which is somewhat intermediate in position when the *Rana-Discodeles-Cornufer-Batrachylodes* series is being considered.

Since 1952 I have worked extensively with this group of ranid frogs (I have now examined 23 of the 28 species referable to the genus), and I agree with Inger that it is indeed difficult to maintain the two genera as distinct entities on the basis of our present knowledge of the digital or other known characters, or on the basis of any great difference in ecological adaptations. Therefore, in the following list I have assigned all of the species previously placed in *Platymantis* to the genus *Cornufer* and noted their distribution. However, a thorough study of these frogs in terms of their morphology and life histories is much needed in determining relationships within the group.

<i>Cornufer aereochordus</i> new species, Pl. 2	Solomon Islands (Bougainville)
<i>Cornufer aculeodactylus</i> (Brown), Pl. 1	Solomon Islands (Bougainville, Choiseul)
<i>Cornufer beauforti</i> (Van Kampen)	Waigen Island (not seen by me)
<i>Cornufer boulengeri</i> Boettger	Bismark Island (not seen by me)
<i>Cornufer cheesmani</i> (Parker)	New Guinea
<i>Cornufer cornutus</i> Taylor	Philippine Islands
<i>Cornufer corrugatus</i> (Duméril)	Philippine Islands
<i>Cornufer dorsalis</i> Duméril	Philippine Islands
<i>Cornufer gilliardi</i> (Zweifel)	Bismark and Admiralty Islands (not seen by me)
<i>Cornufer guentheri</i> Boulenger	Philippine Islands
<i>Cornufer guppyi</i> Boulenger, Pl. 1	Solomon Islands
<i>Cornufer hazelae</i> (Taylor)	Philippine Islands
<i>Cornufer ingeri</i> Brown and Aleala	Philippine Islands
<i>Cornufer macrops</i> new species, Pl. 1	Solomon Islands (Bougainville)
<i>Cornufer moszkowski</i> (Vogt)	New Guinea (not seen by me)
<i>Cornufer myersi</i> (Brown), Pl. 2	Solomon Islands (Bougainville)
<i>Cornufer neckeri</i> Brown and Myers, Pl. 1	Solomon Islands
<i>Cornufer p. papuensis</i> (Meyer)	New Guinea, Bismarks
<i>Cornufer papuensis weberi</i> (Schmidt), Pl. 2	Solomon Islands
<i>Cornufer p. parkeri</i> new species, Pl. 1	Solomon Islands (Bougainville)
<i>Cornufer parkeri bukensis</i> new subspecies,	Solomon Islands (Buka)
<i>Cornufer pelowensis</i> (Peters)	Palau Islands

<i>Cornufer polillensis</i> (Taylor)	Philippine Islands
<i>Cornufer punctata</i> (Peters and Doria)	New Guinea (not seen by me)
<i>Cornufer rubistriatus</i> (Barbour)	Roon Island
<i>Cornufer solomonis</i> Boulenger, Pl. 2	Solomon Islands
<i>Cornufer subterrestris</i> Taylor	Philippine Islands
<i>Cornufer unicolor</i> Tschudi	New Guinea
<i>Cornufer vitianus</i> (Duméril)	Fiji Islands
<i>Cornufer vitiensis</i> (Girard)	Fiji Islands

When considered from a zoogeographical point of view, as shown by this list of species, *Cornufer* appears to represent a relict, peripheral group of ranid frogs with the greatest number of species occurring at present in the fringing Philippine and Solomon archipelagos, and a smaller remnant in New Guinea and related islands, as well as in the Palau and Fiji Islands in the outer Pacific.

NEW SPECIES

The new species collected by Mr. Parker are all relatively small and have been compared directly with the type of *C. aculeodactylus* (USNM 119769) and with a paratype of *C. chcesmani* (MCZ 26501). (The relative sizes at maturity of the several species known from the Solomon Islands are given in Table 1.)

*CORNUFER PARKERI PARKERI*¹ sp. and subsp. nov.

This diminutive frog with its rough, tuberculate skin superficially resembles some of the small Oriental bufonids. However, its firmisternal girdle, well developed omosternum, undilated sacral diapophyses, teeth only on the upper jaw, reduced webs and united outer metatarsals place it in the ranid genus *Cornufer*.

Holotype: MCZ 36923, a mature female collected at Kunua area, Bougainville Island, Solomon Islands, on July 10, 1962, by Fred Parker.

Paratypes: MCZ 36911-18, 36921-22, 38194, 41860, 41866-69, 42524-31, 43741-44, Stanford University Nos. 21773-74, AMNH 70069-71, collected from the same general locality as the holotype, during 1962-1963.

Diagnosis: A diminutive *Cornufer*, largest available mature female measuring 18.5 mm, and largest male 15.9 mm from snout

¹ Named for Mr. Fred Parker.

to vent; skin with numerous warty tubercles on dorsum, lateral surfaces and limbs; first finger shorter than the second; tips of fingers blunt or slightly pointed, occasionally a circummarginal groove faintly indicated; tips of toes scarcely dilated, rather pointed, a shallow groove, most prominent laterally, separating the dorsal from the ventral portions; diameter of eye usually greater than, rarely equal to, length of snout.

Description: A very small *Cornufer*, snout-vent length of 16 mature females 15.1 to 18.5 mm, of 8 mature males 14.0 to 15.9 mm, habitus slender; hind limbs long, the snout-vent length ranging from 60 to 72 per cent of the length of the hind limb for 10 specimens; head about as broad as long; snout round-pointed, upper jaw scarcely protruding; eye large, its diameter somewhat greater than the length of the snout (rarely equal to); tympanum distinct, large, its diameter about 50 to 70 per cent of the diameter of the eye, and usually almost 25 per cent of the breadth of the head; canthus rostralis rounded; loreal region concave, only slightly oblique; a moderately to faintly distinct, oblique fold dorsal and posterior to the tympanum; forelimbs well developed, fingers relatively uniformly slender, bluntly round or slightly pointed, occasionally with a very faint groove separating a ventral pad laterally from the dorsal portion; without webs; subarticular and metacarpal tubercles large and well developed; first finger shorter than the second which is about equal to the fourth (Pl. 1, fig. 3); hind limb long; toes very slender without web, rather pointed with the ventral pad delimited by a shallow groove except at the tip (the fifth toe is more blunt and usually lacks the groove); subarticular and both inner and outer metatarsal tubercles well developed.

Skin of dorsum and dorsolateral surfaces marked by scattered, moderate-sized, round, oval or oblong tubercles; ventral and distal posterior part of the thighs granular; the proximal posterior part of thighs marked by elongate folds.

Color (in preservative): dorsum and lateral surfaces from grayish brown, through brown, to brownish black, the lighter shades with irregular darker blotches; several of the specimens exhibiting a tan, silvery or whitish middorsal band, wider anteriorly than posteriorly, and beginning anteriorly on the posterior part of the head or the pectoral region; lower limbs and edge of jaws with wide, dark transverse bars; venter rather heavily mottled with dark brown.

TABLE 1
Size at maturity of the species of *Coronifer* known from the Solomon Islands
(R = range, N = number)

Shout-vent length at maturity in mm	MALES		FEMALES		<i>C. aculeodactylus</i>	<i>C. guppyi</i>	<i>C. macrops</i>	<i>C. myersi</i>	<i>C. weberi</i>	<i>C. parkeri parkeri</i>	<i>C. parkeri bukacensis</i>	<i>C. parkeri parkeri</i>	<i>C. solomonis</i>	<i>C. acrochordus</i>
	R	N	R	N										
	R = 22.5- 26.8	R = 50.0- 70.4	R = 23.6- 25.9	R = 53.5- 69.3	R = 37.4- 47.2	R = 35.0- 40.0	R = 14.9- 15.4	R = 14.9- 15.9	R = 45.0- 49.0	R = 24.8- 27.1				
	N = 6	N = 7	N = 3	N = 4	N = 17	N = 22	N = 2	N = 2	N = 6	N = 4				

Measurements of holotype (in mm): Snout-vent length 18.5; length of head to posterior edge of tympanum 6.8; breadth of head 6.9; diameter of eye 2.4; diameter of tympanum 1.7; length of snout 2.4; length of hind limbs 27.5; length of tibia 8.1.

Ecological note: Parker (personal communication) states that the specimens of this small frog were found under stones and logs in lowland secondary growth areas.

Comparisons: This *Cornufer* is much smaller at maturity than any other known species of the genus. In the warty nature of the skin it is most similar to *C. aereochoerus*.

CORNUFER PARKERI BUKAENSIS subsp. nov.

Holotype: MCZ 35777, a mature female, collected in lowland forest at south end of Buka Island, Solomon Islands, on January 28, 1962, by Fred Parker.

Paratypes: AMNH 69314-15, same locality as holotype.

Diagnosis: The Buka population is distinguishable from the nominate subspecies by the much less warty skin (both dorsal and ventral surfaces); the larger eye as measured by the ratio of eye diameter to breadth of the head and the relatively broader head as measured by the ratio of the length of the head to its breadth (Table 2).

Because of their obvious close affinities, and the fact that the observable morphological differences between individuals of these populations of diminutive *Cornufer* are based upon a very small sample of the Buka population, I prefer to regard these two populations as geographic subspecies of a polytypic species. Were these populations overlapping in range and were there no intergradation, they would be recognized as full species. As pointed out by Mayr (1963, pp. 481-515), geographically isolated populations such as these island populations are certainly incipient species whether or not marked by pronounced morphological differences. If the isolation is relatively complete for a sufficiently long period of time, true reproductive isolates (distinct species) may arise.

Color (in preservative): Dorsum and upper lateral surfaces more or less uniformly purplish brown or with lighter blotches; lower fore limbs and to some degree the thighs marked with dark transverse bands; venter with a reticulate pattern of brown and grayish white.

Measurements of holotype (in mm): Snout-vent length 15.9; length of head to posterior edge of tympanum 5.9; breadth of head 6.4; diameter of eye 2.1; diameter of tympanum 1.2; length of snout 2.3; length of hind limb 23.5; length of tibia 7.2.

(TABLE 2)

Ratios of diameter of eye to breadth of head, and length of head to breadth of head, for *C. parkeri parkeri* and *C. parkeri bukaensis*
(R = range; M = mean; N = number)

	Diameter of eye Breadth of head	Length of head Breadth of head
<i>C. parkeri parkeri</i>	R = 0.339-0.405 M = 0.376 N = 20	R = 0.966-1.050 M = 1.003 N = 20
<i>C. parkeri bukaensis</i>	R = 0.318-0.328 M = 0.323 N = 3	R = 0.922-0.952 M = 0.937 N = 3

*CORNUFER MACROPS*¹ sp. nov.

Holotype: MCZ 41864, an adult female, collected at 3000 to 4000 feet, in mountains of Aresi area, south of Kunua, Bougainville Island, Solomon Islands, 1963, by Fred Parker.

Paratypes: MCZ 38195-96 and 43740 in mountains of Kunua area, Bougainville Island; Stanford University No. 21795, Kieta area, Bougainville Island, collected by Fred Parker, 1962.

Diagnosis: A small *Cornufer*, largest available mature female measuring 28.5 mm, and largest male 25.9 mm from snout to

¹ From the Greek meaning "large eye."

vent; second finger longer than first; slightly dilated disks at the tips of the fingers and toes; the ventral pad separated from the dorsal by a circummarginal groove; eyes relatively large, diameter of eye greater than length of snout (Table 3), about 40 per cent of head breadth.

Description: A moderately small *Cornufer*, snout-vent length 26.0 to 28.5 mm for the two females; 23.2 to 25.9 mm for the three adult males; habitus slender, tapering from head to groin; hind limbs long; the snout-vent length about 65 per cent of the length of the hind limb; head about as broad as long; snout rounded, upper jaw not protruding; eye very large, its diameter about 16 to 17 per cent of the snout-vent length, greater than the length of the snout (Table 3); tympanum distinct, its diameter slightly more than 20 per cent of the breadth of the head; canthus rostralis rounded; loreal region oblique, concave; a relatively inconspicuous fold above and posterior to the tympanum; fingers relatively long, slender, without web; finger tips slightly dilated and more or less rounded, the ventral pad separated from the dorsal portion by a shallow marginal groove, first finger much shorter than the second which is shorter than the fourth; distal subarticular tubercles large and strongly protruding, basal and metacarpal tubercles less protruding (Pl. 1, fig. 5); hind limb long; toes slender, without web; tips of toes slightly dilated, round or round-pointed, the ventral portion separated from the dorsal by a circummarginal groove; subarticular tubercles moderately large and strongly protruding; inner metatarsal tubercle large and broadly oval, the outer small and round.

Skin of dorsal and dorsolateral surfaces of body and upper surfaces of limbs without prominent tubercles or folds; skin of ventral abdominal region with faint small granules.

Color (in preservative): Dorsal and lateral surfaces blotched light and dark brown; hind limbs with dark crossbars; ventral surfaces heavily flecked with brown.

Measurements of holotype (in mm): Snout-vent length 26.0; length of head to posterior edge of tympanum 10.7; breadth of head 11.1; diameter of eye 4.9; diameter of tympanum 2.3; length of snout 3.9; length of hind limb 44.9; length of tibia 13.6; length of third finger 4.3; diameter of third finger disk 0.8.

Comparisons: *Cornufer macrops* is distinguished from *C. myersi* by its smaller size at maturity and relatively larger eye, diameter of eye greater than length of snout (not less as for *myersi*). It is distinguished from *C. parkeri* by its larger size,

TABLE 3
Significant proportional differences for *C. acrochordus*,
C. aculcodactylus, *C. gilliardi*, *C. macrops*
(R = Range; M = Mean; N = Number)

	Length of third finger Breadth of head	Diameter of eye Length of snout	Breadth of head Snout-vent length	Diameter of eye Snout-vent length
<i>C. acrochordus</i>	R = 0.252-0.312 M = 0.283 N = 13	R = 0.939-1.068 M = 0.993 N = 13	R = 0.427-0.460 M = 0.443 N = 11	R = 0.148-0.166 M = 0.157 N = 13
<i>C. aculcodactylus</i>	R = 0.242-0.304 M = 0.282 N = 10	R = 0.902-0.977 M = 0.948 N = 10	R = 0.381-0.423 M = 0.396 N = 10	R = 0.135-0.143 M = 0.139 N = 10
<i>C. gilliardi</i> ¹			R = 0.390-0.410 M = 0.396 N = 4	R = 0.132-0.140 M = 0.137 N = 4
<i>C. macrops</i>	R = 0.387-0.443 M = 0.424 N = 5	R = 1.167-1.312 M = 1.229 N = 5	R = 0.386-0.427 M = 0.398 N = 5	R = 0.161-0.188 M = 0.173 N = 5

¹ After Zweifel, 1960 (information for first two ratios not available).

In size, *C. macrops* is most similar to the Papuan-Solomon species *C. aculcodactylus*, *C. acrochordus*, n. sp., *C. cheesmanae*, *C. gilliardi* and *C. unicolor*. It differs from *C. aculcodactylus* in its much less pointed fingers; the first finger shorter than the second (not longer) and the fingers longer relative to other measurements, length of third finger to base of second subarticular tubercle about 40 per cent of breadth of head as compared to 25 to 32 per cent in *C. aculcodactylus* (Table 3); smaller, rounded, outer metacarpal tubercle; and eye larger relative to length of snout (Table 3). It differs from *C. gilliardi* in that the first finger is shorter than the second (not longer); head narrower; dorsal folds absent. It differs from *C. acrochordus* in having the skin much less warty; the fingers less pointed; the fingers longer (differences for third finger length relative to breadth of head are shown in Table 3); and the eye larger relative to length of snout (see also Table 3). *C. macrops* differs from *C. cheesmanae* in the larger eye (diameter of eye greater than length of snout, not less than, and more than 35 per cent of breadth of head, not less than as for *cheesmanae*); and the more granular posterior venter. It differs from *C. unicolor* in the absence of a web at the base of the toes, the relatively longer hind limbs; and the relatively broader head.

*CORNUFER ACROCHORDUS*¹ sp. nov.

Holotype: MCZ 44264, a mature female collected at Aresi Mountain region, south of Kunua, between 2000-4000 feet, Bougainville Island, Solomon Islands, on 6 September 1963, by Mr. Fred Parker.

Paratypes: MCZ 44256-63, 44265-66, same general area as the holotype; MCZ 41871-2 and Stanford University 21832, Aresi area south of Kunua (elevation about 3000-4000 feet), Bougainville Island, Solomon Islands.

Diagnosis: A moderate-sized *Cornufer*, largest available mature female measuring 39.3 mm and largest male 27.1 mm from snout to vent; dorsal surfaces of limbs and body with scattered, prominent, roundish tubercles, dorsum also with some elongate folds, venter with coarse, rounded granules; fingers short; first finger longer than the second; fingers and toes distinctly pointed; subarticular and inner metacarpal and metatarsal tubercles very large and strongly protruding.

¹ From the Greek for "warty."

Description: A moderate-sized *Cornufer*, snout-vent length about 25 to 28 mm for mature males (4 measured); 37.0 to 40.0 mm for mature females (6 measured). (Two females about 30 mm in length have undilated, straight oviducts.) Habitus moderately broad and depressed; hind limbs long, snout-vent length 60 to 70 per cent of the length of the hind limb; head broader than long; snout broadly rounded; upper jaw not or scarcely protruding; eye moderately large, its diameter slightly less to slightly greater than the length of the snout and about 15 to 16.5 per cent of the snout-vent length; tympanum distinct, its diameter about 50 to 70 per cent of the diameter of the eye and 19 to 24 per cent of the breadth of the head; canthus rostralis broadly rounded; loreal region strongly oblique and only slightly concave; a prominent fold above and posterior to the tympanum; fingers slender, round-pointed to pointed, ventral pad lacking, without web or lateral fringe; first finger usually longer than second (rarely equal to); second finger about equal in length to the fourth; subarticular tubercles very large and protruding but not pointed (Pl. 2, fig. 4); metacarpal tubercles large, the inner protruding laterally; hind limb relatively long; toes slender, tips of toes slightly dilated, pointed, the ventral portion separated from the dorsal by lateral grooves; subarticular tubercles moderate, strongly protruding, distally pointed; inner metatarsal tubercle large, strongly protruding; the outer a rounded cone; solar and palmar tubercles small but prominent; skin of dorsal and lateral surfaces of head, body and limbs with numerous small to moderate, prominent, rounded or elongate tubercles; dorsum also marked with relatively short folds, the longest pair forming an urn-shaped pattern between the post-orbital and the axillary levels; venter posterior to the fore limbs, and the posterior surface of the thighs marked by prominent, relatively large, rounded tubercles.

Color (in preservative): Dorsum variable, grayish to black, mottled usually with a broad occipital blotch; fore and hind limbs marked by light and dark transverse bars of about equal width; lips with dark bars; venter with brown flecks, heavily concentrated anterior to the fore limbs; areolated light-dark pattern on inner and usually lower surface of thighs.

Measurements of holotype (in mm): Snout-vent length 37.7; length of head to posterior edge of tympanum 15.1; breadth of head 16.5; diameter of eye 5.6; diameter of tympanum 3.3; length of snout 5.9; length of hind limbs 60.5; length of tibia

18.0; length of third finger to base of second subarticular tubercle 5.0.

Eggs: A small clutch of 10 eggs, stated to be of this species by Parker, were measured. In the preserved state they measure 3 or 4 mm in diameter. They are creamy white, without any indication of pigment.

Comparisons: *Cornufer acrochordus* is intermediate in size at maturity between *C. macrops* and *C. papuensis weberi* of species known from the Solomon Islands, and closest to *C. macrops* (Table 1). When compared with extraterritorial species it is of about the same size as *C. dorsalis* from the Philippines and slightly smaller than *C. gilliardi* from New Britain. The sharply pointed and relatively short fingers distinguish *C. acrochordus* from known species of the genus other than *C. aculeodactylus* and possibly *C. gilliardi*. It differs from *C. aculeodactylus* in its larger size (Table 1), much more warty skin, color pattern, larger eye relative to length of snout, and the broader head relative to snout-vent length (Table 3). It differs from *C. gilliardi* in its smaller size, more pointed fingers, more warty skin, broader head, and larger eye (Table 3); the differences from *C. macrops* have been discussed in the section on that species (p. 10).

ARTIFICIAL KEY TO SPECIES OF *CORNUFER* KNOWN FROM THE SOLOMON ISLANDS

1. Tips of fingers broadly dilated, breadth of disk of third finger more than 30 per cent of the length of the third finger as measured to the base of the second subarticular tubercle 2
 Tips of fingers not or scarcely dilated, breadth of disk of third finger, if dilated, less than 20 per cent of the length of the third finger as measured to the base of the second subarticular tubercle 3
2. Head relatively narrow, its breadth usually less than 40 per cent snout-vent length; loreal region slightly or moderately oblique; eye large, its diameter nearly equal to length of snout *neckeri*
 Head relatively broad, its breadth usually greater than 40 per cent snout-vent length; loreal region strongly oblique; eye moderate, its diameter equal to or slightly greater than the distance from eye to nostril *guppyi*
3. First finger distinctly shorter than the second 4
 First finger longer than (occasionally about equal to) the second 5
4. Snout-vent length of adults 20 to 30 mm; tips of fingers and toes round, with moderately dilated disks; fourth finger longer than second *macrops*

- Snout-vent length of adults less than 20 mm; tips of fingers and toes blunt or slightly pointed, scarcely dilated; fourth finger usually shorter than or about equal to second *parkeri*
5. Tips of fingers sharply pointed; fourth finger usually shorter than the second when adpressed 6
 Tips of fingers blunt or rounded; fourth finger usually longer than the second when adpressed 7
6. Skin with numerous prominent warts and dorsal folds; solar area with numerous tubercles *achrochordus*
 Skin relatively smooth; solar area without tubercles *aculcodactylus*
7. Tips of fingers bluntly swollen, lacking a marginal groove delimiting a ventral pad; length of tibia usually less than 50 per cent of snout-vent length *solomonis*
 Tips of fingers with slightly dilated disks, a marginal groove delimiting a ventral pad; length of tibia usually greater than 50 per cent of snout-vent length 8
8. Solar area with prominent tubercles; web at base of toes not reaching proximal edge of subarticular tubercle on inner margin of second toe; dorsum, especially of adults, with numerous narrow folds *papuensis weberi*
 Solar area lacking prominent tubercles; web at base of toes reaching midpoint of subarticular tubercle on inner margin of second toe; dorsum lacking numerous narrow folds *myersi*

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FIGURE 1

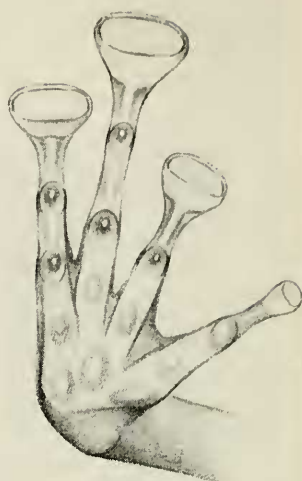


FIGURE 2



FIGURE 3



FIGURE 4



FIGURE 5

PLATE 1

- FIG. 1. *Cornufer guppyi*, inferior view of hand.
FIG. 2. *Cornufer neckeri*, inferior view of hand.
FIG. 3. *Cornufer p. parkeri* n. sp., inferior view of hand.
FIG. 4. *Cornufer aculeodactylus*, inferior view of hand.
FIG. 5. *Cornufer macrops* n. sp., inferior view of hand.



FIGURE 1



FIGURE 2



FIGURE 3



FIGURE 4

PLATE 2

FIG. 1. *Cornufer myersi*, inferior view of hand.

FIG. 2. *Cornufer papuensis weberi*, inferior view of hand.

FIG. 3. *Cornufer solomonis*, inferior view of hand.

FIG. 4. *Cornufer acrochordus* n. sp., inferior view of hand.